Outline of presentation-

Good morning.

On behalf of the Lake Ontario LaMP, I will providing a brief overview of the State of the Lake Ontario ecosystem with respect to biological integrity- focusing on 3 key issues..

Lake Ontario is the last in the chain of Great Lakes

The Lake is the smallest of the Lakes but is relatively deep (average depth 300 feet/ maximum depth 800 feet), with a water retention time estimated to be about 7 years

Since Lake Ontario is the most downstream Great Lake, it is impacted by human activities in the other Great Lakes and connecting channels.

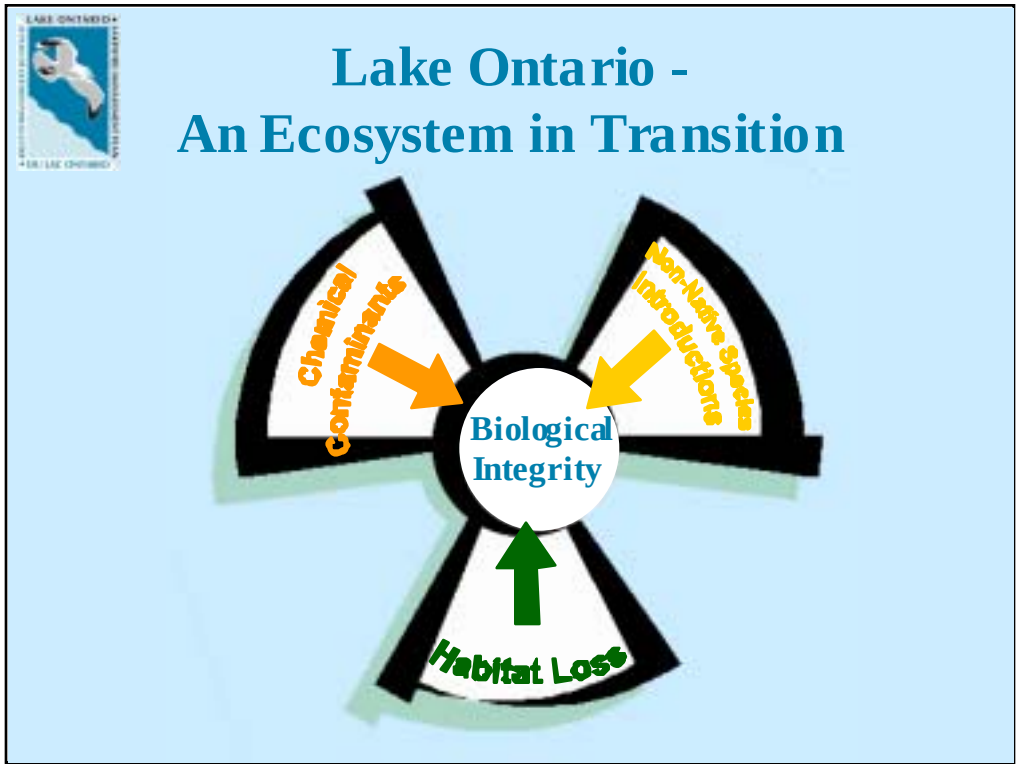
Lake Ontario Basin

Map Credit: Environment Canada

• Agriculture and forests dominate land use within the Lake Ontario watershed.

• Over 8 million people live in the Basin, with most of the population being concentrated on the northwest part of the shoreline on the Canadian side (5.4 million). This area- commonly referred to as the "Golden Horseshoe"- is highly urbanized and industrialized- extending from Port Hope to Niagara Falls. The U.S. side of the lake is not as heavily populated, although there are concentrated areas of urbanization at Rochester, Syracuse and Oswego

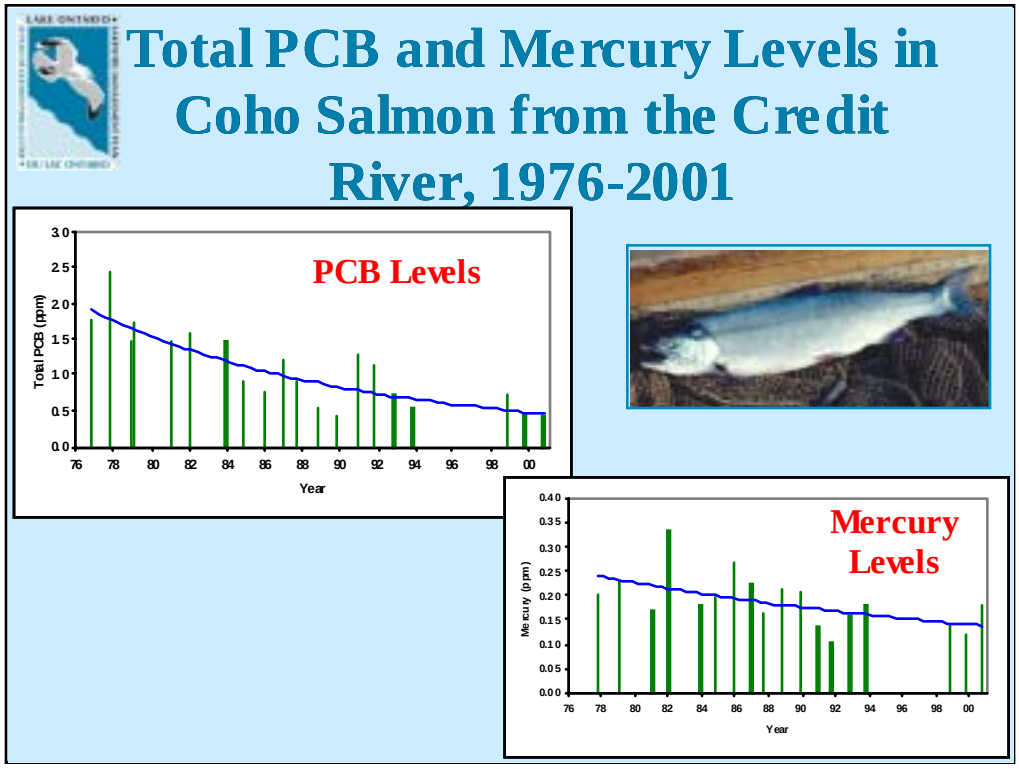
Over 80% of the water flowing into Lake Ontario comes from the upper Great Lakes through the Niagara River.



•Lake Ontario is an "ecosystem in transition".

•Over the years the Lake has been subjected to a number of stresses including: overfishing, nutrient enrichment, contaminant discharges and the introduction of non-native species (eg. alewife, sea lamprey) - which have lead to the degradation of water quality, the loss of fish and wildlife habitat and the decline of native fish communities.

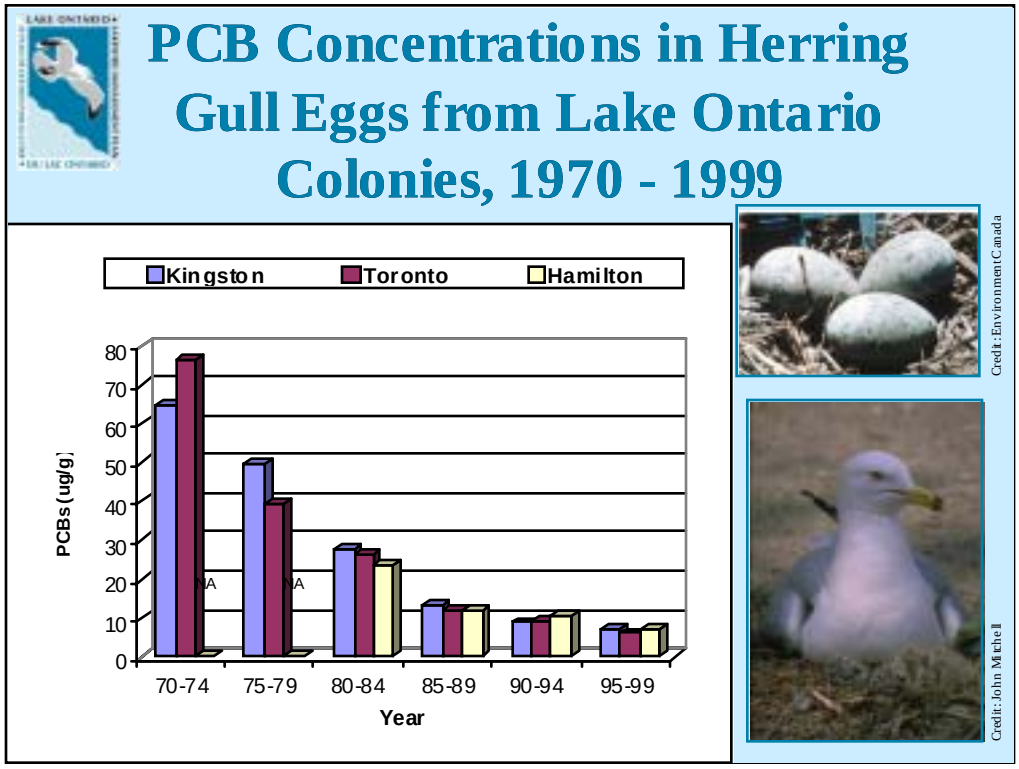
Currently, it is the collective opinion of the LaMP, that Chemical Contaminants, the Introduction of Non-Native Species and Habitat Loss are the most important issues impacting the biological integrity of the Lake.



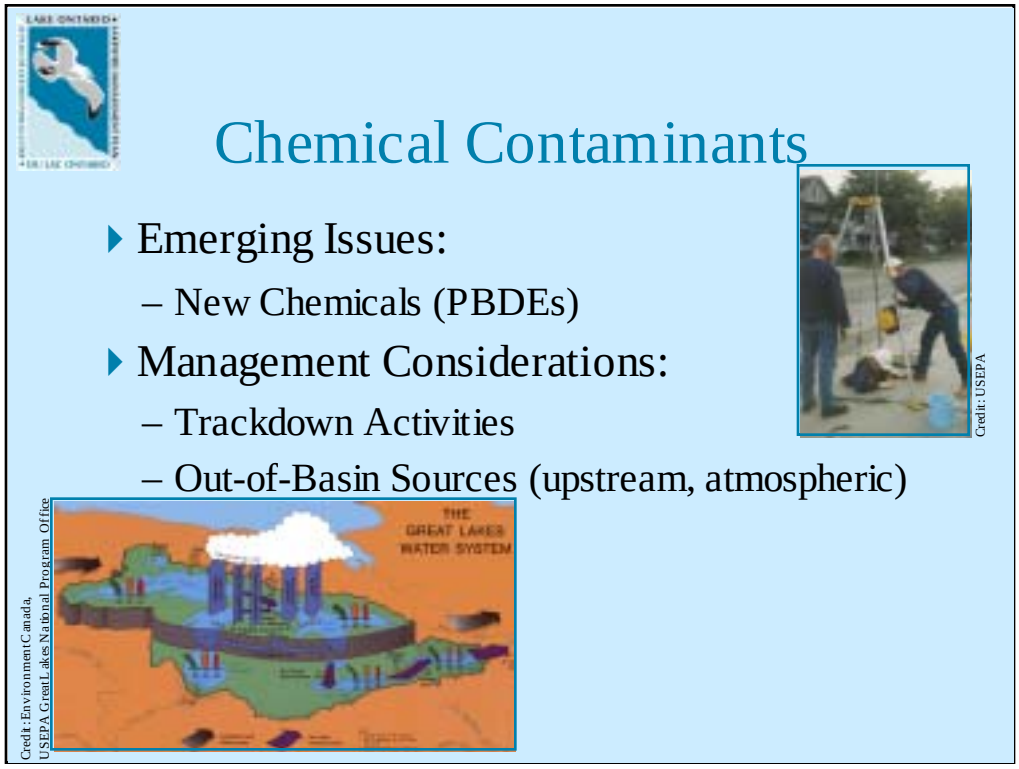
•The Lake Ontario LaMP has identified a number of critical pollutants that have impaired beneficial uses on a lakewide basis. These persistent contaminants (e.g., PCBs, DDT, mirex, dioxin/furans, mercury and dieldrin) tend to bioaccumulate.

•Good News- As a result of actions taken by Canada and the U.S.to ban and control contaminants entering the Great Lakes- levels of contaminants in the Lake Ontario ecosystem have decreased significantly over the last 20 to 25 years. Recent findings presented in LaMP 2002 Report indicate that the management of critical pollutants has been effective in reducing their presence in the ecosystem, and that fish and wildlife have responded positively.

• Critical pollutant levels in fish tissue have shown a significant reduction.For example: levels of critical pollutants in Lake Ontario coho salmon have been decreasing steadily (PCB levels have gone down by 2/3; concentration of mirex has decreased by 1/2.



Similarly, levels of contaminants in herring gull eggs have also decreased dramatically. In the 1970's , fish eating birds in Lake Ontario were found to have very high levels of contaminants in their eggs. They also exhibited much thinner eggshells than normal, elevated rates of embryonic mortality and deformities, total reproductive failure, and declining population levels. Most of these conditions have improved greatly: contaminant levels have declined and population levels have generally increased. Results are encouraging- suggest that the food base for fish eating birds in Lake Ontario is becoming less contaminated.



•Bad news- Environmental sampling in Lake Ontario has shown that PBDE concentrations in fish and wildlife tissue have been increasing dramatically in recent years.

• PBDEs (polybrominated diphenyl ethers) are a class of bioaccumulative chemicals that have been widely used over the last two decades as a flame retardant in textiles, foams, plastics and electrical components (such as computers and televisions).

• We are not sure what the implications of these high levels of PBDEs are. To that end, there are a number of studies underway to evaluate the potential risk PBDEs may pose to fish, wildlife and human health.

•Management Implications- Lake Ontario LaMP 2002 Report provided an update on sources and loadings of critical pollutants to Lake Ontario, using latest available data. Conclusion- it appears that" most significant source of critical pollutants to Lake Ontario now comes from outside the Lake Ontario basin." Upstream sources are responsible for most of the PCBs, DDT and dieldrin that enter the Lake; most of the mires comes from the Niagara River basin; and atmospheric deposition is the other main source.

•The LaMP is focusing its efforts on addressing in-basin sources- using tributary trackdown approach.

Need to also address out-of-basin sources

Non-native Species

U.S. Fish and Wildlife Service

- Zebra & quagga mussels have caused the lake to have 2 new impairments:
  - Benthos
  - Nearshore Phytoplankton
- Impacts are:
  - Food web disruption,
  - Displacement of native species
  - Health of fisheries

Credit: Centre for Great Lakes & aquatic Sciences

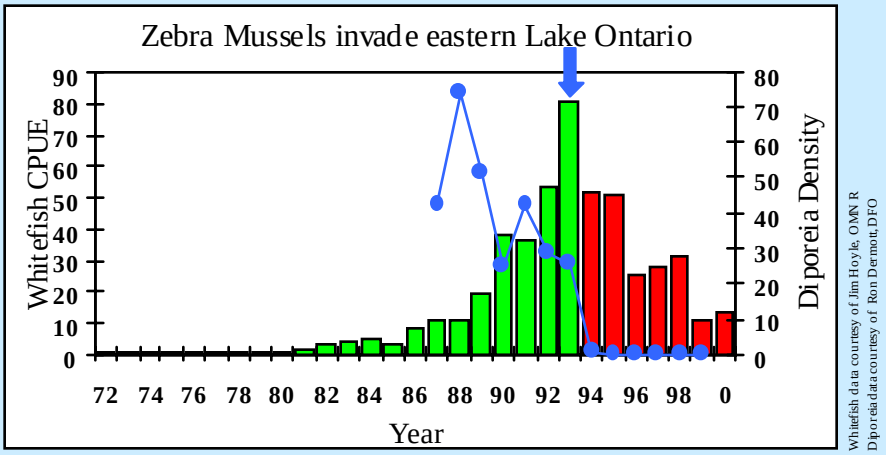
•The introduction of non-native species 2nd Key Issue

•The LaMP recently completed an assessment of benthos and phytoplankton . This assessment concluded that benthos and nearshore phytoplankton populations are degraded primarily due to zebra and quagga mussel impacts.

•These mussels filter water to feed on microscopic phytoplankton and other organic material, thereby reducing the amount of food available to other benthic organisms.

•The filtering action of the mussels has contributed to dramatic improvements in water clarity at the same time, populations of important native benthic organisms have generally declined, and this has created a ripple effect that has affected the health of the fisheries.

Lake Ontario Whitefish Abundance



•This slide illustrates how the introduction of a non-native species has disrupted the Lake Ontario food web and created a ripple effect.

•Prior to the arrival of zebra mussels , Diporeia, a small shrimp-like organism (illustrated by the blue line) , was the dominant benthic organism in the lake.

• Typically, a few thousand of these organisms were present in a square meter of lake bottom and they provided an important source of food for fish, such as whitefish.

•A decade after the zebra mussel invasion, however, fewer than ten of these organisms can be found per square meter in waters up to 200 meters deep.

•This means that there is less food to support lake trout, whitefish and other fish..

•Sequence of events:

• 80s- whitefish populations were recovering (bar graph)

• 90s-zebra mussels invade Lake Ontario - which led to a dramatic decline in Dipoeria abundance which in turn resulted in a decline in whitefish stocks

Impacts are not reversible

Non-Native Species

- Emerging Issues:
  - New Invaders (Round Goby, Spiny Water Flea)
  - Botulism (Type E)
- Management Considerations:
  - Changes Irreversible
  - Future ?

Photos Credit: David Jude, Center for Great Lakes Aquatic Sciences

•As new exotic species continue to be introduced from ballast water from overseas shipping and other sources, the potential for impacts from other non-native species is considerable. Some recently introduced species in Lake Ontario, such as the a fish called the Round Goby and a zooplankton species called the Spiny Water Flea, may take advantage of the unstable conditions in Lake Ontario to expand rapidly as well.

•Another emerging issue is Type E Botulism which has now been detected at a few locations along the Lake Ontario Shoreline.

From a management perspective, it is not clear what the future holds. Once an exotic species is introduced, it disrupts the food web and creates a ripple effect. You can never go back to what you had originally - the changes are irreversible - which is why prevention is the key.

•The 3rd issue I would like to focus on that has impacted biological integrity is Habitat.

•Loss of fish and wildlife habitat is a lakewide problem caused by: artificial lake level management; the introduction of exotic species; and the physical loss, modification or destruction of habitats (through for example, deforestation and damming of tributaries).

• The artificial management.of lake levels has inadvertently reduced the area, quality, and functioning of some Lake Ontario nearshore wetlands. As a result of lake level management, Lake Ontario wetlands are no longer experiencing the same range of periodic high and low water levels.. This reduction in range has resulted in some wetlands becoming a monoculture of cattails- greatly reducing the biodiversity of nearshore areas.

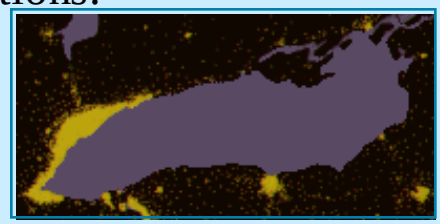
•There has been a long history of loss, modification or destruction of habitats in Lake Ontario- dating back to colonial times: clearing the land; damming of tributaries and streams. Before European settlement, nearly all of the Lake Ontario watershed was forested.

Of special note- are wetlands which provide vital habitat to many of Lake Ontario's wildlife species. It is estimated that about 50% of Lake Ontario's original wetlands throughout the basin have been lost. Along the intensively urbanized coastlines, 60 to 90 % of wetlands have been lost.These losses are a result of the multiple effects associated with urban development and human alterations, such as dyking, dredging, and disturbances by public utilities.

Habitat

- Emerging Issues:
  - Urban Sprawl
  - Agriculture Intensification
  - Land Use Changes
  - Habitat Fragmentation
- Management Considerations:
  - Sustainable Development

Credit: Bay Area Restoration Council



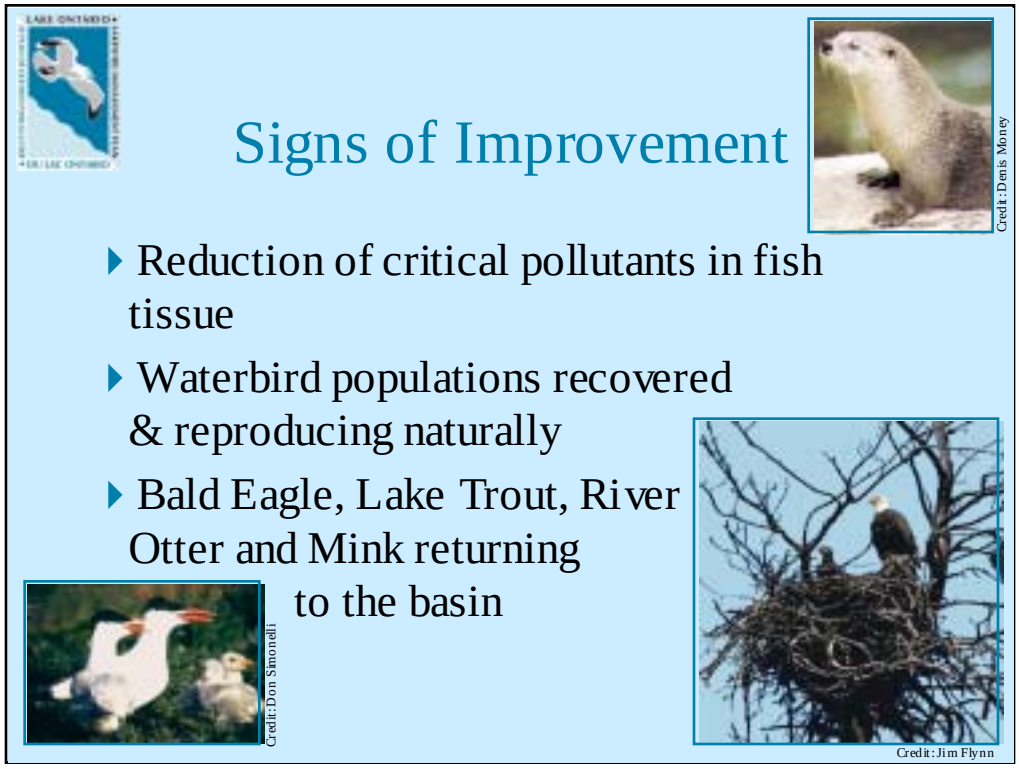
•Land use and population growth are putting enormous stress on the Lake Ontario watershed-

• Human populations are growing very rapidly. By 2020, it is projected that 2 million more people will live in the Lake Ontario Basin.

•Most of the growth will be concentrated in the Greater Toronto Area, where low-density urban sprawl is spreading rapidly over the countryside, removing large areas of farmland and natural habitats. This rapid urban growth is projected to continue around Toronto and in the Hamilton-Niagara area.

•Rural areas are changing too, with larger farms, fewer farmers, and many more country homes in rural subdivisions or scattered lots.Because these residential uses are often located within scenic natural areas, they often come into conflict with wildlife habitats. Other land uses such as golf courses or quarries can remove habitat directly, or can affect the flow and quality of surface water and groundwater feeding local streams and wetlands.

Management Considerations- Can't stop more growth and development- The challenge will be to design our communities to accommodate more people without rampant urban sprawl- and to protect nature for future generations



•In conclusion

•Since the time of European settlement, Lake Ontario and the lands that drain into it have suffered significant abuses. While the nature of that abuse has changed over the decades, and while the ecosystem has shown a remarkable capacity to repair the damage done, new forms of stress keep appearing.

• Good news

•-The major stresses of a generation ago (I.e., nutrient enrichment and toxic contaminants) have been reduced and the lake ecosystem has responded. Since 1970s, there has been a significant reduction in levels of critical pollutants in fish.

• Fish and wildlife populations once on the verge of extinction have rebounded. Populations of fish-eating waterbirds in Lake Ontario have recovered and are reproducing normally. Caspian terns, common terns, gulls and cormorants have all benefited from the reduction of pollutants.

• Several key indicator species such as the bald eagle, lake trout, river otter and mink are also making a comeback in the Lake Ontario ecosystem.

• While still unstable, the offshore habitat zone has largely recovered, and the nearshore zone has shown partial recovery. However, despite site-specific improvements in many areas, much of the watershed, tributaries and nearshore lands remain degraded (especially on the Canadian side).

Challenges for the future:

• The loss of biodiversity and the ongoing invasion of non-native species are the two most important challenges facing the Lake Ontario ecosystem

•Additional efforts are also needed to maintain the momentum on cleaning up past pollution and to conserve the remaining areas of high-quality habitat

•Only through such ongoing efforts can the rich diversity of fish and wildlife in Lake Ontario and its watershed be assured- now and for future generations

Acknowledgements/ Sources of Information:

Lake Ontario LaMP 2002 Biennial Report (2002)

Lakewide Management Plan for Lake Ontario, Stage 1: Problem Definition (1998)

Status and Trends of Fish and Wildlife Habitat on the Canadian Side of Lake Ontario (2001)